SEQUENCE LISTING

<110> Brownlie, John
       Chalker, Victoria J.
       Erles, Kerstin

<120> CANINE RESPIRATORY CORONAVIRUS (CRCV) SPIKE PROTEIN, POLYMERASE AND
HEMAGGLUTININ/ESTERASE

<130> ERP02.003APC

<140> US 10/522,513
<141> 2006-06-22

<150> PCT/GB03/02832
<151> 2003-07-01

<150> GB 0217434.0
<151> 2002-07-27

<160> 52

<170> PatentIn version 3.1

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Ile Gly Thr Thr Lys Phe Tyr Gly Gly Trp Asp Asp Met Leu Arg Arg
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<213>  canine respiratory coronavirus

<400>  4
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            20                  25                  30


Ala Pro Ser Ile Ser Thr Asp Val Val Asp Val Thr Asn Gly Leu Gly
        35                  40                  45


Thr Tyr Tyr Val Leu Asp Arg Val Tyr Leu Asn Thr Thr Leu Leu Leu
    50                  55                  60


Asn Gly Tyr Tyr Pro Thr Ser Gly Ser Thr Tyr Arg Asn Met Ala Leu
65                  70                  75                  80


Lys Gly Thr Leu Leu Leu Ser Thr Leu Trp Phe Lys Pro Pro Phe Leu
                85                  90                  95


Ser Asp Phe Ile Asp Gly Val Phe Ala Lys Val Lys Asn Thr Lys Val
            100                 105                 110


Ile Lys Asp Gly Val Val Tyr Ser Glu Phe Pro Ala Ile Thr Ile Gly
            115                 120                 125
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Ser Thr Phe Val Asn Thr Ser Tyr Ser Val Val Val Gln Pro His Thr
    130                 135                 140

Thr Asn Leu Asp Asn Lys Leu Gln Gly Leu Leu Glu Ile Ser Val Cys
145                 150                 155                 160

Gln Tyr Thr Met Cys Asp Tyr Pro His Thr Met Cys His Pro Asn Leu
                165                 170                 175

Gly Asn Lys Arg Ile Glu Leu Trp His Trp Asp Thr Gly Val Val Pro
            180                 185                 190

Cys Leu Tyr Lys Arg Asn Phe Thr Tyr Asp Val Asn Ala Asp Tyr Leu
        195                 200                 205

Tyr Ser His Phe Tyr Gln Glu Gly Gly Thr Phe Tyr Ala Tyr Phe Thr
    210                 215                 220

Asp Thr Gly Val Val Thr Lys Phe Leu Phe His Val Tyr Leu Gly Thr
225                 230                 235                 240

Val Leu Ser His Tyr Tyr Val Met Pro Leu Thr Cys Asn Ser Ala Met
                245                 250                 255

Thr Leu Glu Tyr Trp Val Thr Pro Leu Thr Phe Lys Gln Tyr Leu Leu
            260                 265                 270

Ala Phe Asn Gln Asp Gly Val Ile Phe Asn Ala Val Asp Cys Lys Ser
        275                 280                 285

Asp Phe Met Ser Glu Ile Lys Cys Lys Thr Leu Ser Ile Ala Pro Ser
    290                 295                 300

Thr Gly Val Tyr Glu Leu Asn Gly Tyr Thr Val Gln Pro Ile Ala Asp
305                 310                 315                 320

Val Tyr Arg Arg Ile Pro Asn Leu Pro Asp Cys Asn Ile Glu Ala Trp
            325                 330                 335

Leu Asn Asp Lys Ser Val Pro Ser Pro Leu Asn Trp Glu Arg Lys Thr
            340                 345                 350

Phe Ser Asn Cys Asn Phe Asn Met Ser Ser Leu Met Ser Phe Ile Gln
        355                 360                 365

Ala Asp Ser Phe Thr Cys Asn Asn Ile Asp Ala Ala Lys Ile Tyr Gly
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Met Cys Phe Phe Ser Ile Thr Ile Asp Lys Phe Ala Ile Pro Asn Gly
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Arg Lys Val Asp Leu Gln Met Gly Asn Leu Gly Tyr Leu Gln Ser Phe
            405   410   415

Asn Tyr Arg Ile Asp Thr Thr Ala Thr Ser Cys Gln Leu Tyr Tyr Asn
            420   425   430

Leu Pro Ala Ser Asn Val Ser Ile Ser Arg Phe Asn Pro Ser Ile Trp
        435   440   445

Asn Arg Arg Phe Gly Phe Thr Glu Gln Ser Val Phe Lys Pro Gln Pro
    450   455   460

Val Gly Val Phe Thr Asp His Asp Val Val Tyr Ala Gln His Cys Phe
465   470   475   480

Lys Ala Pro Thr Asn Phe Cys Pro Cys Lys Leu Asn Gly Ser Leu Cys
            485   490   495

Val Gly Ser Gly Phe Gly Ile Asp Ala Gly Tyr Lys Asn Ser Gly Ile
        500   505   510

Gly Thr Cys Pro Ala Gly Thr Asn Tyr Leu Thr Cys Tyr Asn Ala Asn
        515   520   525

Gln Cys Asp Cys Leu Cys Thr Pro Asp Pro Ile Leu Ser Lys Ser Thr
    530   535   540

Gly Pro Tyr Lys Cys Pro Gln Thr Lys Tyr Leu Val Gly Ile Gly Glu
545   550   555   560

His Cys Ser Gly Leu Ala Ile Lys Ser Asp Tyr Cys Gly Gly Asn Pro
            565   570   575

Cys Thr Cys Gln Pro Lys Ala Phe Leu Gly Trp Ser Val Asp Ser Cys
        580   585   590

Leu Gln Gly Asp Arg Cys Asn Ile Phe Ala Asn Phe Ile Leu His Gly
        595   600   605

Val Asn Ser Gly Thr Thr Cys Ser Thr Asp Leu Gln Lys Ser Asn Thr
    610   615   620

Asp Ile Ile Leu Gly Val Cys Val Asn Tyr Asp Leu Tyr Gly Ile Thr
625   630   635   640

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Gln Asn Leu Leu Tyr Asp Ser Asn Gly Asn Leu Tyr Gly Phe Arg Asp
          660             665             670

Tyr Leu Thr Asn Arg Thr Phe Met Ile Arg Ser Cys Tyr Ser Gly Arg
      675             680             685

Val Ser Ala Gly Phe His Ser Asn Ser Ser Glu Pro Ala Leu Leu Phe
    690             695             700

Arg Asn Ile Lys Cys Asn Tyr Val Phe Asn Asn Thr Leu Ser Arg Gln
705             710             715             720

Leu Gln Pro Ile Asn Tyr Phe Asp Ser Tyr Leu Gly Cys Val Val Asn
              725             730             735

Ala Asp Asn Ser Thr Ser Ser Ser Val Gln Thr Cys Asp Leu Thr Val
              740             745             750

Gly Ser Gly Tyr Trp Gly Asp Tyr Ser Thr Gln Arg Arg Ser Arg Arg
          755             760             765

Thr Ile Thr Thr Gly Tyr Arg Phe Thr Asn Phe Glu Pro Phe Thr Val
    770             775             780

Asn Pro Val Asn Asp Ser Leu His Pro Val Gly Gly Leu Tyr Glu Ile
785             790             795             800

Gln Ile Pro Ser Glu Phe Thr Ile Gly Asn Met Glu Glu Phe Ile Gln
              805             810             815

Thr Arg Ser Pro Lys Val Thr Ile Asp Cys Pro Val Phe Val Cys Gly
          820             825             830

Asp Tyr Ala Ala Cys Lys Ser Gln Leu Val Glu Tyr Gly Ser Phe Cys
          835             840             845

Asp Asn Ile Asn Ala Ile Leu Thr Glu Val Asn Glu Leu Leu Asp Thr
    850             855             860

Thr Gln Leu Gln Val Ala Asn Ser Leu Met Asn Gly Val Thr Leu Ser
865             870             875             880

Thr Lys Leu Lys Asp Gly Phe Asn Phe Asn Val Asp Asp Ile Asn Phe
          885             890             895
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Ser Pro Val Leu Gly Cys Leu Gly Ser Glu Cys Asn Lys Val Ser Ser
            900                 905                 910


Arg Ser Ala Ile Glu Asp Leu Leu Phe Ser Lys Val Lys Leu Ser Asp
        915                 920                 925


Val Gly Phe Val Asp Ala Tyr Asn Asn Cys Thr Gly Gly Ala Glu Ile
    930                 935                 940


Arg Asp Leu Ile Cys Val Gln Ser Tyr Asn Gly Ile Lys Val Leu Pro
945                 950                 955                 960


Pro Leu Leu Ser Glu Asn Gln Ile Ser Gly Tyr Thr Leu Ala Ala Thr
            965                 970                 975


Phe Ala Ser Leu Phe Pro Pro Trp Ser Ala Ala Ala Gly Val Pro Phe
            980                 985                 990


Tyr Leu Asn Val Gln Tyr Arg Ile  Asn Gly Ile Gly Val  Thr Met Asp
        995                 1000                1005


Val Leu  Thr Gln Asn Gln Lys  Leu Ile Ser Asn Ala  Phe Asn Asn
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Ala Leu  Asp Ala Ile Gln Glu  Gly Phe Asp Ala Thr  Asn Ser Ala
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Leu Val  Lys Ile Gln Ala Val  Val Asn Ala Asn Ala  Glu Ala Leu
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Asn Asn  Leu Leu Gln Gln Leu  Ser Asn Lys Phe Gly  Ala Ile Ser
    1055                1060                1065


Ala Ser  Leu Gln Glu Ile Leu  Ser Arg Leu Asp Ala  Leu Glu Ala
    1070                1075                1080


Gln Ala  Gln Ile Asp Arg Leu  Ile Asn Gly Arg Leu  Thr Ala Leu
    1085                1090                1095


Asn Ala  Tyr Val Ser Gln Gln  Leu Ser Asp Ser Thr  Leu Val Lys
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Phe Ser  Ala Ala Gln Ala Met  Glu Lys Val Asn Glu  Cys Val Lys
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Ser Gln  Ser Ser Arg Ile Asn  Phe Cys Gly Asn Gly  Asn His Ile
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Ile Ser  Leu Val Gln Asn Ala  Pro Tyr Gly Leu Tyr  Phe Ile His
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Phe Ser  Tyr Val Pro Thr Lys  Tyr Val Thr Ala Lys  Val Ser Pro
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Gly Leu  Cys Ile Ala Gly Asp  Arg Gly Ile Ala Pro  Lys Ser Gly
    1175                 1180                 1185


Tyr Phe  Val Asn Val Asn Asn  Thr Trp Met Phe Thr  Gly Ser Gly
    1190                 1195                 1200


Tyr Tyr  Tyr Pro Glu Pro Ile  Thr Gly Asn Asn Val  Val Val Met
    1205                 1210                 1215


Ser Thr  Cys Ala Val Asn Tyr  Thr Lys Ala Pro Asp  Val Met Leu
    1220                 1225                 1230


Asn Ile  Ser Thr Pro Asn Leu  Pro Asp Phe Lys Glu  Glu Leu Asp
    1235                 1240                 1245


Gln Trp  Phe Lys Asn Gln Thr  Leu Met Ala Pro Asp  Leu Ser Leu
    1250                 1255                 1260


Asp Tyr  Ile Asn Val Thr Phe  Leu Asp Leu Gln Asp  Glu Met Asn
    1265                 1270                 1275


Arg Leu  Gln Glu Ala Ile Lys  Val Leu Asn His Ser  Tyr Ile Asn
    1280                 1285                 1290


Leu Lys  Asp Ile Gly Thr Tyr  Glu Tyr Tyr Val Lys  Trp Pro Trp
    1295                 1300                 1305


Tyr Val  Trp Leu Leu Ile Gly  Leu Ala Gly Val Ala  Met Leu Val
    1310                 1315                 1320


Leu Leu  Phe Phe Ile Cys Cys  Cys Thr Gly Cys Gly  Thr Ser Cys
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Phe Lys  Lys Cys Gly Gly Cys  Cys Asp Asp Tyr Thr  Gly His Gln
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Glu Leu  Val Ile Lys Thr Ser  His Asp Asp
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<212> DNA
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ctaagtgtga                                                              250
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<212> DNA
<213> hemagglutinating encephalomyelitis virus

<400> 7

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cagctacacg tggcgttcct gtggttatag gcaccactaa attttatggc ggctgggatg        180

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<212> DNA
<213> canine enteric coronavirus

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Lys Cys Leu Lys Ser Ile Ala Ala Thr Arg Gly Val Pro Val Val Ile
            35   40   45

Gly Thr Thr Lys Phe Tyr Gly Gly Trp Asp Asp Met Leu Arg Arg Leu
        50   55   60

Ile Lys Asp Val Asp Asn Pro Val Leu Met Gly Trp Asp Tyr Pro Lys
65   70   75   80

Cys

<210> 10
<211> 81
<212> PRT
<213> hemagglutinating encephalomyelitis virus

<400> 10

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Ala Gly Val Ser Ile Leu Ser Thr Met Thr Gly Arg Met Phe His Gln
            20   25   30

Lys Cys Leu Lys Ser Ile Ala Ala Thr Arg Gly Val Pro Val Val Ile
            35   40   45

Gly Thr Thr Lys Phe Tyr Gly Gly Trp Asp Asp Met Leu Arg Arg Leu
        50   55   60

Ile Lys Asp Val Asp Asn Pro Val Leu Met Gly Trp Asp Tyr Pro Lys
65   70   75   80

Cys

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<212> PRT
<213> bovine coronavirus strain LY138

<400> 11

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Lys Cys Leu Lys Ser Ile Ala Ala Thr Arg Gly Val Pro Val Val Ile
        35   40   45

Gly Thr Thr Lys Phe Tyr Gly Gly Trp Asp Asp Met Leu Arg Arg Leu
    50   55   60

Ile Lys Asp Val Asp Asn Pro Val Leu Met Gly Trp Asp Tyr Pro Lys
65   70   75   80

Cys

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<213> canine enteric coronavirus

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            20   25   30

Tyr His Gln Lys His Leu Lys Ser Ile Ala Ala Thr Arg Asn Ala Thr
        35   40   45

Val Val Ile Gly Ser Thr Lys Phe Tyr Gly Gly Trp Asp Asn Met Leu
    50   55   60

Lys Asn Leu Met Arg Asp Val Asp Asn Gly Cys Leu Met Gly Trp Asp
65   70   75   80

Tyr Pro Lys Cys

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<212> DNA
<213> canine enteric coronavirus

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accactgtgc gcaagtgttt tgctgcagtt acaaacgcta ctaagtgtac ttgctggtgt     1560

caaccagatc cttccacata taaaggtgta aatgcctgga cttgtccgca atctaaagtt     1620

tctatacaac caggtcagca ttgccctggc ttgggtcttg tggaggatga ttgctctggt     1680

aatccttgca cttgtaaacc acaggctttc ataggctgga gttcagaaac ttgtttgcaa     1740

aatggtaggt gtaatatttt tgctaatttt attttgaatg atgttaatag cggtactacc     1800

tgttctactg atttacaaca gggtaatact aatattacta ctgatgtttg tgttaattat     1860

gacctatatg gcattacagg ccagggcata cttatagaag ttaatgccac gtattataat     1920

agttggcaga atcttcttta tgattctagt ggtaatctct atggctttag agattatttta     1980

tcaaatagaa cctttcttat tcgtagctgc tatagtggaa gagtttcagc agtctttcat     2040

gctaactctt ctgaaccagc tttgatgttt cgtaatctta aatgcagcca cgttttttaat     2100

tataccattt taagacaaat acagcttgtt aattattttg atagttacct tggttgtgtt     2160
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gttaatgctt ataataatac agctagtgct gtaagtactt gtgatttaac cgttggtagc   2220

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cgctttacta attttgaacc atttgccgct aatttggtaa atgatagtat agaacctgtt   2340

ggtggtttgt atgaaataca gataccttca gagtttacca ttggtaattt agaagaattc   2400

attcaaacga gttcccctaa ggttactata gattgtgcta catttgtttg tggtgactat   2460

gctgcatgta dacaacagtt agctgagtat ggtagttttt gtgagaacat taatgctata   2520

ctcatagaag taaatgaact acttgacact acacagttgc aagtagctaa tagtttaatg   2580

aatggagtca cccttagtac taagattaag gatgggatta atttcaatgt tgacgatatc   2640

aacttctcct ctgtattagg ttgtttagga agcgaatgta acagagcttc cactagatct   2700

gctatagagg atttactttt tgataaagta aaattgtctg atgtcggttt tgtacaggcc   2760

tataataact gcactggagg agccgaaatt agggatctca tttgtgtgca aagttataat   2820

ggtatcaaag tgttgcctcc attgttatct gaaaatcaga ttagtggtta cacttcggca   2880

gccaccgctg ctagcctatt tcctccctgg acagctgcag caggtgtacc attttatta   2940

aatgttcagt atcgtataaa tgggcttggc gtcaccatgg atgtgctaag ccaaaaccaa   3000

aagcttattg ctagtgcatt taacaacgct cttgattcta tccaggaagg gttcgacgca   3060

accaattctg ctttagttaa aattcaggct gttgttaatg caaatgctga agcacttaat   3120

aacttattgc agcaactctc taacagattt ggtgccataa gtgcctcttt acaagaaatt   3180

ttatccaggc tcgatgctct tgaagctaaa gctcagatag acagacttat taatgggcgt   3240

ctcaccgctc ttaatgctta tgtttctcag cagcttagtg attctacact agtaaaattt   3300

agtgcagcac aagctattga gaaagttaat gaatgtgtta aaagccaatc atctaggata   3360

aatttctgtg gtaatggtaa tcatattata tcattagtac agaatgctcc atatggtttg   3420

tattttatcc attttagcta tgtccccacc aagtatgtta cagcaaaggt tagtcctggt   3480

ttgtgcattg ctggcgatat aggaatatcg cctaagagtg gttattttat taatgtaaat   3540

aactcttgga tgttcactgg tagtggctat tactaccctg aacctataac ccaaaataat   3600

gttgttgtga tgagtacgtg tgctgttaat tatactaaag caccggatct aatgctgaac   3660

acatcgacac ccaaccttcc tgatttcaag gaagaattgt atcaatggtt taaaaaccaa   3720

tcttcattgg caccagattt gtcatttgat tatattaatg ttacgttctt ggacctacaa   3780

gatgaaatga ataggttaca agaagctata aaagttctaa atcatagcta catcaatctc   3840

aaggacattg gtacatatga gtattatgtg aaatggcctt ggtatgtatg cttttaatt   3900

tgccttgctg gtgtagttat gcttgtttta ctattcttca tatgctgctg tacaggatgt   3960

gggactagtt gttttaagaa atgtggcggt tgttttgatg attatactgg acaccaggag   4020

tttgtaatca aaacttcaca tgacgattaa tttcgt                            4056
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<210> 17
<211> 1363
<212> PRT
<213> bovine coronavirus strain LY138

<400> 17

Met Phe Leu Ile Leu Leu Ile Ser Leu Pro Met Ala Leu Ala Val Ile
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Gly Asp Leu Lys Cys Thr Thr Val Ser Ile Asn Asp Val Asp Thr Gly
            20   25   30

Val Pro Ser Val Ser Thr Asp Thr Val Asp Val Thr Asn Gly Leu Gly
            35   40   45

Thr Tyr Tyr Val Leu Asp Arg Val Tyr Leu Asn Thr Thr Leu Leu Leu
    50   55   60

Asn Gly Tyr Tyr Pro Thr Ser Gly Ser Thr Tyr Arg Asn Met Ala Leu
65   70   75   80

Lys Gly Thr Leu Leu Leu Ser Thr Leu Trp Phe Lys Pro Pro Phe Leu
                85   90   95

Ser Asp Phe Ile Asn Gly Ile Phe Ala Lys Val Lys Asn Thr Lys Val
            100   105   110

Ile Lys Asn Gly Val Met Tyr Ser Glu Phe Pro Ala Ile Thr Ile Gly
        115   120   125

Ser Thr Phe Val Asn Thr Ser Tyr Ser Val Val Val Gln Pro His Thr
    130   135   140

Thr Asn Leu Asp Asn Lys Leu Gln Gly Leu Leu Glu Ile Ser Val Cys
145   150   155   160

Gln Tyr Thr Met Cys Glu Tyr Pro His Thr Ile Cys His Pro Asn Leu
                165   170   175

Gly Asn Arg Arg Ile Glu Leu Trp His Trp Asp Thr Gly Val Val Ser
            180   185   190

Cys Leu Tyr Lys Arg Asn Phe Thr Tyr Asp Val Asn Ala Asp Tyr Leu
        195   200   205

Tyr Phe His Phe Tyr Gln Glu Gly Gly Thr Phe Tyr Ala Tyr Phe Thr
    210   215   220

```
Asp Thr Gly Val Val Thr Lys Phe Leu Phe Asn Val Tyr Leu Gly Thr
225             230         235         240
```

```
Val Leu Ser His Tyr Tyr Val Met Pro Leu Thr Cys Asn Ser Ala Met
            245         250         255
```

```
Thr Leu Glu Tyr Trp Val Thr Pro Leu Thr Ser Lys Gln Tyr Leu Leu
            260         265         270
```

```
Ala Phe Asn Gln Asp Gly Val Ile Phe Asn Ala Val Asp Cys Lys Ser
        275         280         285
```

```
Asp Phe Met Ser Glu Ile Lys Cys Lys Thr Leu Ser Ile Ala Pro Ser
    290         295         300
```

```
Thr Gly Val Tyr Glu Leu Asn Gly Tyr Thr Val Gln Pro Ile Ala Asp
305             310         315         320
```

```
Val Tyr Arg Arg Ile Pro Asn Leu Pro Asp Cys Asn Ile Glu Ala Trp
            325         330         335
```

```
Leu Asn Asp Lys Ser Val Pro Ser Pro Leu Asn Trp Glu Arg Lys Thr
            340         345         350
```

```
Phe Ser Asn Cys Asn Phe Asn Met Ser Ser Leu Met Ser Phe Ile Gln
            355         360         365
```

```
Ala Asp Ser Phe Thr Cys Asn Asn Ile Asp Ala Ala Lys Ile Tyr Gly
    370         375         380
```

```
Met Cys Phe Ser Ser Ile Thr Ile Asp Lys Phe Ala Ile Pro Asn Gly
385             390         395         400
```

```
Arg Lys Val Asp Leu Gln Leu Gly Asn Leu Gly Tyr Leu Gln Ser Phe
            405         410         415
```

```
Asn Tyr Arg Ile Asp Thr Thr Ala Thr Ser Cys Gln Leu Tyr Tyr Asn
            420         425         430
```

```
Leu Pro Ala Ala Asn Val Ser Val Ser Arg Phe Asn Pro Ser Thr Trp
            435         440         445
```

```
Asn Arg Arg Phe Gly Phe Thr Glu Gln Ser Val Phe Lys Pro Gln Pro
    450         455         460
```

```
Val Gly Val Phe Thr Asp His Asp Val Val Tyr Ala Gln His Cys Phe
465             470         475         480
```

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Lys Ala Pro Thr Asn Phe Cys Pro Cys Lys Leu Asp Gly Ser Leu Cys
            485   490   495

Val Gly Ser Gly Ser Gly Ile Asp Ala Gly Tyr Lys Asn Ser Gly Ile
            500   505   510

Gly Thr Cys Pro Ala Gly Thr Asn Tyr Leu Thr Cys His Asn Ala Ala
            515   520   525

Gln Cys Asn Cys Leu Cys Thr Pro Asp Pro Ile Thr Ser Lys Ser Thr
            530   535   540

Gly Pro Tyr Lys Cys Pro Gln Thr Lys Tyr Leu Val Gly Ile Gly Glu
545   550   555   560

His Cys Ser Gly Leu Ala Ile Lys Ser Asp Tyr Cys Gly Gly Asn Pro
            565   570   575

Cys Thr Cys Gln Pro Gln Ala Phe Leu Gly Trp Ser Val Asp Ser Cys
            580   585   590

Leu Gln Gly Asp Arg Cys Asn Ile Phe Ala Asn Phe Ile Leu His Asp
            595   600   605

Val Asn Ser Gly Thr Thr Cys Ser Thr Asp Leu Gln Lys Ser Asn Thr
            610   615   620

Asp Ile Ile Leu Gly Val Cys Val Asn Tyr Asp Leu Tyr Gly Ile Thr
625   630   635   640

Gly Gln Gly Ile Phe Val Glu Val Asn Ala Thr Tyr Tyr Asn Ser Trp
            645   650   655

Gln Asn Leu Leu Tyr Asp Ser Asn Gly Asn Leu Tyr Gly Phe Arg Asp
            660   665   670

Tyr Leu Thr Asn Arg Thr Phe Met Ile Arg Ser Cys Tyr Ser Gly Arg
            675   680   685

Val Ser Ala Ala Phe His Ala Asn Ser Ser Glu Pro Ala Leu Leu Phe
            690   695   700

Arg Asn Ile Lys Cys Asn Tyr Val Phe Asn Asn Thr Leu Ser Arg Gln
705   710   715   720

Leu Gln Pro Ile Asn Tyr Phe Asp Ser Tyr Leu Gly Cys Val Val Asn
            725   730   735

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Ala Asp Asn Ser Thr Ser Ser Ala Val Gln Thr Cys Asp Leu Thr Val
            740   745   750

Gly Ser Gly Tyr Cys Val Asp Tyr Ser Thr Lys Arg Arg Ser Arg Arg
        755   760   765

Ala Ile Thr Thr Gly Tyr Arg Phe Thr Asn Phe Glu Pro Phe Thr Val
    770   775   780

Asn Ser Val Asn Asp Ser Leu Glu Pro Val Gly Gly Leu Tyr Glu Ile
785   790   795   800

Gln Ile Pro Ser Glu Phe Thr Ile Gly Asn Met Glu Glu Phe Ile Gln
            805   810   815

Ile Ser Ser Pro Lys Val Thr Ile Asp Cys Ser Ala Phe Val Cys Gly
            820   825   830

Asp Tyr Ala Ala Cys Lys Ser Gln Leu Val Glu Tyr Gly Ser Phe Cys
        835   840   845

Asp Asn Ile Asn Ala Ile Leu Thr Glu Val Asn Glu Leu Leu Asp Thr
    850   855   860

Thr Gln Leu Gln Val Ala Asn Ser Leu Met Asn Gly Val Thr Leu Ser
865   870   875   880

Thr Lys Leu Lys Asp Gly Val Asn Phe Asn Val Asp Asp Ile Asn Phe
            885   890   895

Ser Pro Val Leu Gly Cys Leu Gly Ser Asp Cys Asn Lys Val Ser Ser
            900   905   910

Arg Ser Ala Ile Glu Asp Leu Leu Phe Ser Lys Val Lys Leu Ser Asp
        915   920   925

Val Gly Phe Val Glu Ala Tyr Asn Asn Cys Thr Gly Gly Ala Glu Ile
    930   935   940

Arg Asp Leu Ile Cys Val Gln Ser Tyr Asn Gly Ile Lys Val Leu Pro
945   950   955   960

Pro Leu Leu Ser Glu Asn Gln Ile Ser Gly Tyr Thr Leu Ala Ala Thr
            965   970   975

Ser Ala Ser Leu Phe Pro Pro Trp Ser Ala Ala Ala Gly Val Pro Phe
            980   985   990

Tyr Leu Asn Val Gln Tyr Arg Ile Asn Gly Ile Gly Val Thr Met Asp
        995   1000   1005

Val Leu Ser Gln Asn Gln Lys Leu Ile Ala Asn Ala Phe Asn Asn
    1010   1015   1020

Ala Leu Asp Ala Ile Gln Glu Gly Phe Asp Ala Thr Asn Ser Ala
    1025   1030   1035

Leu Val Lys Ile Gln Ala Val Val Asn Ala Asn Ala Glu Ala Leu
    1040   1045   1050

Asn Asn Leu Leu Gln Gln Leu Ser Asn Arg Phe Gly Ala Ile Ser
    1055   1060   1065

Ser Ser Leu Gln Glu Ile Leu Ser Arg Leu Asp Ala Leu Glu Ala
    1070   1075   1080

Gln Ala Gln Ile Asp Arg Leu Ile Asn Gly Arg Leu Thr Ala Leu
    1085   1090   1095

Asn Ala Tyr Val Ser Gln Gln Leu Ser Asp Ser Thr Leu Val Lys
    1100   1105   1110

Phe Ser Ala Ala Gln Ala Met Glu Lys Val Asn Glu Cys Val Lys
    1115   1120   1125

Ser Gln Ser Ser Arg Ile Asn Phe Cys Gly Asn Gly Asn His Ile
    1130   1135   1140

Ile Ser Leu Val Gln Asn Ala Pro Tyr Gly Leu Tyr Phe Ile His
    1145   1150   1155

Phe Ser Tyr Val Pro Thr Lys Tyr Val Thr Ala Lys Val Ser Pro
    1160   1165   1170

Gly Leu Cys Ile Ala Gly Asp Arg Gly Ile Ala Pro Lys Ser Gly
    1175   1180   1185

Tyr Phe Val Asn Val Asn Asn Thr Trp Met Phe Thr Gly Ser Gly
    1190   1195   1200

Tyr Tyr Tyr Pro Glu Pro Ile Thr Gly Asn Asn Val Val Val Met
    1205   1210   1215

Ser Thr Cys Ala Val Asn Tyr Thr Lys Ala Pro Asp Val Met Leu
    1220   1225   1230

```
Asn Ile  Ser Thr Pro Asn Leu  Pro Asp Phe Lys Glu  Glu Leu Asp
    1235                 1240             1245
```

```
Gln Trp  Phe Lys Asn Gln Thr  Ser Val Ala Pro Asp  Leu Ser Leu
    1250                 1255             1260
```

```
Asp Tyr  Ile Asn Val Thr Phe  Leu Asp Leu Gln Asp  Glu Met Asn
    1265                 1270             1275
```

```
Arg Leu  Gln Glu Ala Ile Lys  Val Leu Asn Gln Ser  Tyr Ile Asn
    1280                 1285             1290
```

```
Leu Lys  Asp Ile Gly Thr Tyr  Glu Tyr Tyr Val Lys  Trp Pro Trp
    1295                 1300             1305
```

```
Tyr Val  Trp Leu Leu Ile Gly  Leu Ala Gly Val Ala  Met Leu Val
    1310                 1315             1320
```

```
Leu Leu  Phe Phe Ile Cys Cys  Cys Thr Gly Cys Gly  Thr Ser Cys
    1325                 1330             1335
```

```
Phe Lys  Lys Cys Gly Gly Cys  Cys Asp Asp Tyr Thr  Gly His Gln
    1340                 1345             1350
```

```
Glu Leu  Val Ile Lys Thr Ser  His Asp Asp
    1355                 1360
```

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<210>  18
<211>  1363
<212>  PRT
<213>  human coronavirus strain OC43

<400>  18
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Met Phe Leu Ile Leu Leu Ile Ser Leu Pro Thr Ala Phe Ala Val Ile
1               5               10              15
```

```
Gly Asp Leu Lys Cys Thr Thr Val Ser Ile Asn Asp Ile Asp Thr Gly
            20              25              30
```

```
Ala Pro Ser Ile Ser Thr Asp Ile Val Asp Val Thr Asn Gly Leu Gly
        35              40              45
```

```
Thr Tyr Tyr Val Leu Asp Arg Val Tyr Leu Asn Thr Thr Leu Leu Leu
    50              55              60
```

```
Asn Gly Tyr Tyr Pro Thr Ser Gly Ser Thr Tyr Arg Asn Met Ala Leu
65              70              75              80
```

Lys Gly Thr Leu Leu Leu Ser Arg Leu Trp Phe Lys Pro Pro Phe Leu
              85   90   95

Ser Asp Phe Ile Asn Gly Ile Phe Ala Lys Val Lys Asn Thr Lys Val
             100   105   110

Ile Lys Lys Gly Val Met Tyr Ser Glu Phe Pro Ala Ile Thr Ile Gly
         115   120   125

Ser Thr Phe Val Asn Thr Ser Tyr Ser Val Val Val Gln Pro His Thr
     130   135   140

Thr Asn Leu Asp Asn Lys Leu Gln Gly Leu Leu Glu Ile Ser Val Cys
145   150   155   160

Gln Tyr Thr Met Cys Glu Tyr Pro His Thr Ile Cys His Pro Asn Leu
             165   170   175

Gly Asn Arg Arg Val Glu Leu Trp His Trp Asp Thr Gly Val Val Ser
         180   185   190

Cys Leu Tyr Lys Arg Asn Phe Thr Tyr Asp Val Asn Ala Asp Tyr Leu
         195   200   205

Tyr Phe His Phe Tyr Gln Glu Gly Gly Thr Phe Tyr Ala Tyr Phe Thr
     210   215   220

Asp Thr Gly Val Val Thr Lys Phe Leu Phe Asn Val Tyr Leu Gly Thr
225   230   235   240

Val Leu Ser His Tyr Tyr Val Leu Pro Leu Thr Cys Asn Ser Ala Met
             245   250   255

Thr Leu Glu Tyr Trp Val Thr Pro Leu Thr Ser Lys Gln Tyr Leu Leu
             260   265   270

Ala Phe Asn Gln Asp Gly Val Ile Phe Asn Ala Val Asp Cys Lys Ser
         275   280   285

Asp Phe Met Ser Glu Ile Lys Cys Lys Thr Leu Ser Ile Ala Pro Ser
     290   295   300

Thr Gly Val Tyr Glu Leu Asn Gly Tyr Thr Val Gln Pro Ile Ala Asp
305   310   315   320

Val Tyr Arg Arg Ile Pro Asn Leu Pro Asp Cys Asn Ile Glu Ala Trp
             325   330   335

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Leu Asn Asp Lys Ser Val Pro Ser Pro Leu Asn Trp Glu Arg Lys Thr
                340   345   350

Phe Ser Asn Cys Asn Phe Asn Met Ser Ser Leu Met Ser Phe Ile Gln
        355   360   365

Ala Asp Ser Phe Thr Cys Asn Asn Ile Asp Ala Ala Lys Ile Tyr Gly
    370   375   380

Met Cys Phe Ser Ser Ile Thr Ile Asp Lys Phe Ala Ile Pro Asn Gly
385   390   395   400

Arg Lys Val Asp Leu Gln Leu Gly Asn Leu Gly Tyr Leu Gln Ser Phe
                405   410   415

Asn Tyr Arg Ile Asp Thr Thr Ala Thr Ser Cys Gln Leu Tyr Tyr Asn
            420   425   430

Leu Pro Ala Ala Asn Val Ser Val Ser Arg Phe Asn Pro Ser Thr Trp
        435   440   445

Asn Arg Arg Phe Gly Phe Thr Glu Gln Ser Val Phe Lys Pro Gln Pro
    450   455   460

Val Gly Val Phe Thr His His Asp Val Val Tyr Ala Gln His Cys Phe
465   470   475   480

Lys Ala Pro Thr Asn Phe Cys Pro Cys Lys Leu Asp Gly Ser Leu Cys
            485   490   495

Val Gly Asn Gly Pro Gly Ile Asp Ala Gly Tyr Lys Asn Ser Gly Ile
            500   505   510

Gly Thr Cys Pro Ala Gly Thr Asn Tyr Leu Thr Cys His Asn Ala Ala
        515   520   525

Gln Cys Asp Cys Leu Cys Thr Pro Asp Pro Ile Thr Ser Lys Ser Thr
    530   535   540

Gly Pro Tyr Lys Cys Pro Gln Thr Lys Tyr Leu Val Gly Ile Gly Glu
545   550   555   560

His Cys Ser Gly Leu Ala Ile Lys Ser Asp Tyr Cys Gly Gly Asn Pro
            565   570   575

Cys Thr Cys Gln Pro Gln Ala Phe Leu Gly Trp Ser Val Asp Ser Cys
            580   585   590

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```
Leu Gln Gly Asp Arg Cys Asn Ile Phe Ala Asn Phe Ile Leu His Asp
        595                 600                 605

Val Asn Ser Gly Thr Thr Cys Ser Thr Asp Leu Gln Lys Ser Asn Thr
        610             615                 620

Asp Ile Ile Leu Gly Val Cys Val Asn Tyr Asp Leu Tyr Gly Ile Thr
625                 630                 635                 640

Gly Gln Gly Ile Phe Val Glu Val Asn Ala Pro Tyr Tyr Asn Ser Trp
            645                 650                 655

Gln Asn Leu Leu Tyr Asp Ser Asn Gly Asn Leu Tyr Gly Phe Arg Asp
        660                 665                 670

Tyr Leu Thr Asn Arg Thr Phe Met Ile Arg Ser Cys Tyr Ser Gly Arg
        675                 680                 685

Val Ser Ala Ala Phe His Ala Asn Ser Ser Glu Pro Ala Leu Leu Phe
        690                 695                 700

Arg Asn Ile Lys Cys Ser Tyr Val Phe Asn Asn Thr Leu Ser Arg Gln
705                 710                 715                 720

Leu Gln Pro Ile Asn Tyr Phe Asp Ser Tyr Leu Gly Cys Val Val Asn
            725                 730                 735

Ala Asp Asn Ser Thr Ser Ser Val Val Gln Thr Cys Asp Leu Thr Val
            740                 745                 750

Gly Ser Gly Tyr Cys Val Asp Tyr Ser Thr Lys Arg Arg Ser Arg Arg
        755                 760                 765

Ala Ile Thr Thr Gly Tyr Arg Phe Thr Asn Phe Glu Pro Phe Thr Val
    770                 775                 780

Asn Ser Val Asn Asp Ser Leu Glu Pro Val Gly Gly Leu Tyr Glu Ile
785                 790                 795                 800

Gln Ile Pro Ser Glu Phe Thr Ile Gly Asn Met Glu Glu Phe Ile Gln
            805                 810                 815

Thr Ser Ser Pro Lys Val Thr Ile Asp Cys Ser Ala Phe Val Cys Gly
            820                 825                 830

Asp Tyr Ala Ala Cys Lys Ser Gln Leu Val Glu Tyr Gly Ser Phe Cys
        835                 840                 845
```

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```
Asp Asn Ile Asn Ala Ile Leu Thr Glu Val Asn Glu Leu Leu Asp Thr
    850                 855             860

Thr Gln Leu Gln Val Ala Asn Ser Leu Met Asn Gly Val Thr Leu Ser
865             870             875                 880

Thr Lys Leu Lys Asp Gly Val Asn Phe Asn Val Asp Asp Ile Asn Phe
                885             890             895

Ser Pro Val Leu Gly Cys Leu Gly Ser Ala Cys Asn Lys Val Ser Ser
            900             905             910

Arg Ser Ala Ile Glu Asp Leu Leu Phe Ser Lys Val Lys Leu Ser Asp
        915             920             925

Val Gly Phe Val Glu Ala Tyr Asn Asn Cys Thr Gly Gly Ala Glu Ile
    930             935             940

Arg Asp Leu Ile Cys Val Gln Ser Tyr Asn Gly Ile Lys Val Leu Pro
945             950             955                 960

Pro Leu Leu Ser Val Asn Gln Ile Ser Gly Tyr Thr Leu Ala Ala Thr
            965             970             975

Ser Ala Ser Leu Phe Pro Pro Trp Ser Ala Ala Ala Gly Val Pro Phe
            980             985             990

Tyr Leu Asn Val Gln Tyr Arg Ile  Asn Gly Ile Gly Val  Thr Met Asp
        995             1000            1005

Val Leu  Ser Gln Asn Gln Lys  Leu Ile Ala Asn Ala  Phe Ser Asn
    1010            1015            1020

Ala Leu  Asp Ala Ile Gln Glu  Gly Phe Asp Ala Thr  Asn Ser Ala
    1025            1030            1035

Leu Val  Lys Ile Gln Ala Val  Val Asn Ala Asn Ala  Glu Ala Leu
    1040            1045            1050

Asn Asn  Leu Leu Gln Gln Leu  Ser Asn Arg Phe Gly  Ala Ile Gly
    1055            1060            1065

Ser Ser  Leu Gln Glu Ile Leu  Ser Arg Leu Asp Ala  Leu Glu Ala
    1070            1075            1080

Gln Ala  Gln Ile Asp Arg Leu  Ile Asn Gly Arg Leu  Thr Ala Leu
    1085            1090            1095
```

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Asn Ala Tyr Val Ser Gln Gln Leu Ser Asp Ser Thr Leu Val Lys
    1100   1105   1110

Phe Ser Ala Ala Gln Ala Met Glu Lys Val Asn Glu Cys Val Lys
    1115   1120   1125

Ser Gln Ser Ser Arg Ile Asn Phe Cys Gly Asn Gly Asn His Ile
    1130   1135   1140

Ile Ser Leu Val Gln Asn Ala Pro Tyr Gly Leu Tyr Phe Ile His
    1145   1150   1155

Phe Ser Tyr Val Pro Thr Lys Tyr Val Thr Ala Lys Val Ser Pro
    1160   1165   1170

Gly Leu Cys Ile Ala Gly Asp Arg Gly Ile Ala Pro Lys Ser Gly
    1175   1180   1185

Tyr Phe Val Asn Val Asn Asn Thr Trp Met Phe Thr Gly Ser Gly
    1190   1195   1200

Tyr Tyr Tyr Pro Glu Pro Ile Thr Gly Asn Asn Val Val Val Met
    1205   1210   1215

Ser Thr Cys Ala Val Asn Tyr Thr Lys Ala Pro Asp Val Met Leu
    1220   1225   1230

Asn Ile Ser Thr Pro Asn Leu His Asp Phe Lys Glu Glu Leu Asp
    1235   1240   1245

Gln Trp Phe Lys Asn Gln Thr Ser Val Ala Pro Asp Leu Ser Leu
    1250   1255   1260

Asp Tyr Ile Asn Val Thr Phe Leu Asp Leu Gln Asp Glu Met Asn
    1265   1270   1275

Arg Leu Gln Glu Ala Ile Lys Val Leu Asn Gln Ser Tyr Ile Asn
    1280   1285   1290

Leu Lys Asp Ile Gly Thr Tyr Glu Tyr Tyr Val Lys Trp Pro Trp
    1295   1300   1305

Tyr Val Trp Leu Leu Ile Gly Phe Ala Gly Val Ala Met Leu Val
    1310   1315   1320

Leu Leu Phe Phe Ile Cys Cys Cys Thr Gly Cys Gly Thr Ser Cys
    1325   1330   1335

```
Phe Lys  Ile Cys Gly Gly Cys  Cys Asp Asp Tyr Thr  Gly His Gln
    1340            1345            1350


Glu Leu  Val Ile Lys Thr Ser  His Asp Asp
    1355            1360
```

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<210>  19
<211>  1349
<212>  PRT
<213>  hemagglutinating encephalomyelitis virus

<400>  19

Met Phe Phe Ile Leu Leu Ile Thr Leu Pro Ser Val Phe Ala Val Ile
1               5               10              15


Gly Asp Leu Lys Cys Asn Thr Ser Ser Ile Asn Asp Val Asp Thr Gly
            20              25              30


Val Pro Ser Ile Ser Ser Glu Val Val Asp Val Thr Asn Gly Leu Gly
        35              40              45


Thr Phe Tyr Val Leu Asp Arg Val Tyr Leu Asn Thr Thr Leu Leu Leu
    50              55              60


Asn Gly Tyr Tyr Pro Ile Ser Gly Ala Thr Phe Arg Asn Val Ala Leu
65              70              75              80


Lys Gly Thr Arg Leu Leu Ser Thr Leu Trp Phe Lys Pro Pro Phe Leu
            85              90              95


Ser Pro Phe Asn Asp Gly Ile Phe Ala Lys Val Lys Asn Ser Arg Phe
            100             105             110


Ser Lys His Gly Val Ile Tyr Ser Glu Phe Pro Ala Ile Thr Ile Gly
        115             120             125


Ser Thr Phe Val Asn Thr Ser Tyr Ser Ile Val Val Lys Pro His Thr
    130             135             140


Ser Phe Ile Asn Gly Asn Leu Gln Gly Phe Leu Gln Ile Ser Val Cys
145             150             155             160


Gln Tyr Thr Met Cys Glu Tyr Pro Gln Thr Ile Cys His Pro Asn Leu
                165             170             175


Gly Asn Gln Arg Ile Glu Leu Trp His His Asp Thr Asp Val Val Ser
            180             185             190


Cys Leu Tyr Arg Arg Asn Phe Thr Tyr Asp Val Asn Ala Asp Tyr Leu
```

```
                        195                      200                         205

Tyr Phe His Phe Tyr Gln Glu Gly Gly Thr Phe Tyr Ala Tyr Phe Thr
    210             215             220

Asp Thr Gly Phe Val Thr Lys Phe Leu Phe Lys Leu Tyr Leu Gly Thr
225             230             235                         240

Val Leu Ser His Tyr Tyr Val Met Pro Leu Thr Cys Asp Ser Ala Leu
            245             250                     255

Ser Leu Glu Tyr Trp Val Thr Pro Leu Thr Thr Arg Gln Phe Leu Leu
            260             265                     270

Ala Phe Asp Gln Asp Gly Val Leu Tyr His Ala Val Asp Cys Ala Ser
        275             280             285

Asp Phe Met Ser Glu Ile Met Cys Lys Thr Ser Ser Ile Thr Pro Pro
    290             295             300

Thr Gly Val Tyr Glu Leu Asn Gly Tyr Thr Val Gln Pro Val Ala Thr
305             310             315                         320

Val Tyr Arg Arg Ile Pro Asp Leu Pro Asn Cys Asp Ile Glu Ala Trp
            325             330             335

Leu Asn Ser Lys Thr Val Ser Ser Pro Leu Asn Trp Glu Arg Lys Ile
            340             345             350

Phe Ser Asn Cys Asn Phe Asn Met Gly Arg Leu Met Ser Phe Ile Gln
        355             360             365

Ala Asp Ser Phe Gly Cys Asn Asn Ile Asp Ala Ser Arg Leu Tyr Gly
    370             375             380

Met Cys Phe Gly Ser Ile Thr Ile Asp Lys Phe Ala Ile Pro Asn Ser
385             390             395                         400

Arg Lys Val Asp Leu Gln Val Gly Lys Ser Gly Tyr Leu Gln Ser Phe
            405             410                     415

Asn Tyr Lys Ile Asp Thr Ala Val Ser Ser Cys Gln Leu Tyr Tyr Ser
            420             425             430

Leu Pro Ala Ala Asn Val Ser Val Thr His Tyr Asn Pro Ser Ser Trp
    435             440             445

Asn Arg Arg Tyr Gly Phe Ile Asn Gln Ser Phe Gly Ser Arg Gly Leu
```

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450   455   460

His Asp Ala Val Tyr Ser Gln Gln Cys Phe Asn Thr Pro Asn Thr Tyr
465   470   475   480

Cys Pro Cys Arg Thr Ser Gln Cys Ile Gly Gly Ala Gly Thr Gly Thr
                485   490   495

Cys Pro Val Gly Thr Thr Val Arg Lys Cys Phe Ala Ala Val Thr Asn
            500   505   510

Ala Thr Lys Cys Thr Cys Trp Cys Gln Pro Asp Pro Ser Thr Tyr Lys
        515   520   525

Gly Val Asn Ala Trp Thr Cys Pro Gln Ser Lys Val Ser Ile Gln Pro
    530   535   540

Gly Gln His Cys Pro Gly Leu Gly Leu Val Glu Asp Asp Cys Ser Gly
545   550   555   560

Asn Pro Cys Thr Cys Lys Pro Gln Ala Phe Ile Gly Trp Ser Ser Glu
            565   570   575

Thr Cys Leu Gln Asn Gly Arg Cys Asn Ile Phe Ala Asn Phe Ile Leu
            580   585   590

Asn Asp Val Asn Ser Gly Thr Thr Cys Ser Thr Asp Leu Gln Gln Gly
        595   600   605

Asn Thr Asn Ile Thr Thr Asp Val Cys Val Asn Tyr Asp Leu Tyr Gly
    610   615   620

Ile Thr Gly Gln Gly Ile Leu Ile Glu Val Asn Ala Thr Tyr Tyr Asn
625   630   635   640

Ser Trp Gln Asn Leu Leu Tyr Asp Ser Ser Gly Asn Leu Tyr Gly Phe
            645   650   655

Arg Asp Tyr Leu Ser Asn Arg Thr Phe Leu Ile Arg Ser Cys Tyr Ser
            660   665   670

Gly Arg Val Ser Ala Val Phe His Ala Asn Ser Ser Glu Pro Ala Leu
        675   680   685

Met Phe Arg Asn Leu Lys Cys Ser His Val Phe Asn Tyr Thr Ile Leu
    690   695   700

Arg Gln Ile Gln Leu Val Asn Tyr Phe Asp Ser Tyr Leu Gly Cys Val
                              Page 35

Val Asn Ala Tyr Asn Asn Thr Ala Ser Ala Val Ser Thr Cys Asp Leu
            725   730   735

Thr Val Gly Ser Gly Tyr Cys Val Asp Tyr Val Thr Ala Leu Arg Ser
        740   745   750

Arg Arg Ser Phe Thr Thr Gly Tyr Arg Phe Thr Asn Phe Glu Pro Phe
        755   760   765

Ala Ala Asn Leu Val Asn Asp Ser Ile Glu Pro Val Gly Gly Leu Tyr
    770   775   780

Glu Ile Gln Ile Pro Ser Glu Phe Thr Ile Gly Asn Leu Glu Glu Phe
785   790   795   800

Ile Gln Thr Ser Ser Pro Lys Val Thr Ile Asp Cys Ala Thr Phe Val
            805   810   815

Cys Gly Asp Tyr Ala Ala Cys Arg Gln Gln Leu Ala Glu Tyr Gly Ser
            820   825   830

Phe Cys Glu Asn Ile Asn Ala Ile Leu Ile Glu Val Asn Glu Leu Leu
        835   840   845

Asp Thr Thr Gln Leu Gln Val Ala Asn Ser Leu Met Asn Gly Val Thr
    850   855   860

Leu Ser Thr Lys Ile Lys Asp Gly Ile Asn Phe Asn Val Asp Asp Ile
865   870   875   880

Asn Phe Ser Ser Val Leu Gly Cys Leu Gly Ser Glu Cys Asn Arg Ala
            885   890   895

Ser Thr Arg Ser Ala Ile Glu Asp Leu Leu Phe Asp Lys Val Lys Leu
        900   905   910

Ser Asp Val Gly Phe Val Gln Ala Tyr Asn Asn Cys Thr Gly Gly Ala
        915   920   925

Glu Ile Arg Asp Leu Ile Cys Val Gln Ser Tyr Asn Gly Ile Lys Val
    930   935   940

Leu Pro Pro Leu Leu Ser Glu Asn Gln Ile Ser Gly Tyr Thr Ser Ala
945   950   955   960

Ala Thr Ala Ala Ser Leu Phe Pro Pro Trp Thr Ala Ala Ala Gly Val

Pro Phe Tyr Leu Asn Val Gln Tyr Arg Ile Asn Gly Leu Gly Val Thr
        980   985   990

Met Asp Val Leu Ser Gln Asn Gln Lys Leu Ile Ala Ser Ala Phe Asn
        995   1000   1005

Asn Ala Leu Asp Ser Ile Gln Glu Gly Phe Asp Ala Thr Asn Ser
        1010   1015   1020

Ala Leu Val Lys Ile Gln Ala Val Val Asn Ala Asn Ala Glu Ala
        1025   1030   1035

Leu Asn Asn Leu Leu Gln Gln Leu Ser Asn Arg Phe Gly Ala Ile
        1040   1045   1050

Ser Ala Ser Leu Gln Glu Ile Leu Ser Arg Leu Asp Ala Leu Glu
        1055   1060   1065

Ala Lys Ala Gln Ile Asp Arg Leu Ile Asn Gly Arg Leu Thr Ala
        1070   1075   1080

Leu Asn Ala Tyr Val Ser Gln Gln Leu Ser Asp Ser Thr Leu Val
        1085   1090   1095

Lys Phe Ser Ala Ala Gln Ala Ile Glu Lys Val Asn Glu Cys Val
        1100   1105   1110

Lys Ser Gln Ser Ser Arg Ile Asn Phe Cys Gly Asn Gly Asn His
        1115   1120   1125

Ile Ile Ser Leu Val Gln Asn Ala Pro Tyr Gly Leu Tyr Phe Ile
        1130   1135   1140

His Phe Ser Tyr Val Pro Thr Lys Tyr Val Thr Ala Lys Val Ser
        1145   1150   1155

Pro Gly Leu Cys Ile Ala Gly Asp Ile Gly Ile Ser Pro Lys Ser
        1160   1165   1170

Gly Tyr Phe Ile Asn Val Asn Asn Ser Trp Met Phe Thr Gly Ser
        1175   1180   1185

Gly Tyr Tyr Tyr Pro Glu Pro Ile Thr Gln Asn Asn Val Val Val
        1190   1195   1200

Met Ser Thr Cys Ala Val Asn Tyr Thr Lys Ala Pro Asp Leu Met

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         1205                    1210                    1215


Leu Asn  Thr Ser Thr Pro Asn  Leu Pro Asp Phe Lys  Glu Glu Leu
    1220                 1225                 1230


Tyr Gln  Trp Phe Lys Asn Gln  Ser Ser Leu Ala Pro  Asp Leu Ser
    1235                 1240                 1245


Phe Asp  Tyr Ile Asn Val Thr  Phe Leu Asp Leu Gln  Asp Glu Met
    1250                 1255                 1260


Asn Arg  Leu Gln Glu Ala Ile  Lys Val Leu Asn His  Ser Tyr Ile
    1265                 1270                 1275


Asn Leu  Lys Asp Ile Gly Thr  Tyr Glu Tyr Tyr Val  Lys Trp Pro
    1280                 1285                 1290


Trp Tyr  Val Trp Leu Leu Ile  Cys Leu Ala Gly Val  Val Met Leu
    1295                 1300                 1305


Val Leu  Leu Phe Phe Ile Cys  Cys Cys Thr Gly Cys  Gly Thr Ser
    1310                 1315                 1320


Cys Phe  Lys Lys Cys Gly Gly  Cys Phe Asp Asp Tyr  Thr Gly His
    1325                 1330                 1335


Gln Glu  Phe Val Ile Lys Thr  Ser His Asp Asp
    1340                 1345
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<210>  20
<211>  1453
<212>  PRT
<213>  canine enteric coronavirus

<400>  20
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Met Ile Val Leu Val Thr Cys Ile Leu Leu Leu Cys Ser Tyr His Thr
1                   5                   10                  15


Ala Ser Ser Thr Ser Asn Asn Asp Cys Arg Gln Val Asn Val Thr Gln
            20                  25                  30


Leu Asp Gly Asn Glu Asn Leu Ile Arg Asp Phe Leu Phe Gln Asn Phe
        35                  40                  45


Lys Glu Glu Gly Thr Val Val Val Gly Gly Tyr Tyr Pro Thr Glu Val
    50                  55                  60


Trp Tyr Asn Cys Ser Arg Thr Ala Thr Thr Thr Ala Tyr Glu Tyr Phe
65                  70                  75                  80
```

```
Ser Asn Ile His Ala Phe Tyr Phe Asp Met Glu Ala Met Glu Asn Ser
              85              90              95


Thr Gly Asn Ala Arg Gly Lys Pro Leu Leu Phe His Val His Gly Glu
            100             105             110


Pro Val Ser Val Ile Ile Tyr Ile Ser Tyr Arg Asp Asp Val Gln His
        115             120             125


Arg Pro Leu Leu Lys His Gly Leu Val Cys Ile Thr Glu Ser Arg Asn
    130             135             140


Ile Asp Tyr Asn Ser Phe Thr Ser Ser Gln Trp Asn Ser Ile Cys Thr
145             150             155             160


Gly Asn Asp Arg Lys Ile Pro Phe Ser Val Ile Pro Thr Asp Asn Gly
            165             170             175


Thr Lys Ile Tyr Gly Leu Glu Trp Asn Asp Glu Phe Val Thr Ala Tyr
            180             185             190


Ile Ser Gly Arg Ser Tyr Asn Trp Asn Ile Asn Asn Asn Trp Phe Asn
        195             200             205


Asn Val Thr Leu Leu Tyr Ser Arg Ser Ser Thr Ala Thr Trp Gln His
    210             215             220


Ser Ala Ala Tyr Val Tyr Gln Gly Val Ser Asn Phe Thr Tyr Tyr Lys
225             230             235             240


Leu Asn Asn Thr Asn Gly Leu Lys Thr Tyr Glu Leu Cys Glu Asp Tyr
            245             250             255


Glu Tyr Cys Thr Gly Tyr Ala Thr Asn Ile Phe Ala Pro Thr Val Gly
            260             265             270


Gly Tyr Ile Pro Asp Gly Phe Ser Phe Asn Asn Trp Phe Leu Leu Thr
        275             280             285


Asn Ser Ser Thr Phe Val Ser Gly Arg Phe Val Thr Asn Gln Pro Leu
    290             295             300


Leu Val Asn Cys Leu Trp Pro Val Pro Ser Phe Gly Val Ala Ala Gln
305             310             315             320


Glu Phe Cys Phe Glu Gly Ala Gln Phe Ser Gln Cys Asn Gly Val Phe
            325             330             335
```

Leu Asn Asn Thr Val Asp Val Ile Arg Phe Asn Leu Asn Phe Thr Ala
340 345 350

Asp Val Gln Ser Gly Met Gly Ala Thr Val Phe Ser Leu Asn Thr Thr
355 360 365

Gly Gly Cys Ile Leu Glu Ile Ser Cys Tyr Asn Asp Ile Val Ser Glu
370 375 380

Ser Ser Phe Tyr Ser Tyr Gly Glu Ile Pro Phe Gly Val Thr Asp Gly
385 390 395 400

Pro Arg Tyr Cys Tyr Val Leu Tyr Asn Gly Thr Ala Leu Lys Tyr Phe
405 410 415

Gly Thr Leu Pro Pro Ser Val Lys Glu Ile Ala Ile Ser Lys Trp Gly
420 425 430

Gln Phe Tyr Ile Asn Gly Tyr Asn Phe Phe Ser Thr Phe Pro Ile Asp
435 440 445

Cys Ile Ser Phe Asn Leu Thr Thr Gly Asp Ser Gly Ala Phe Trp Thr
450 455 460

Ile Ala Tyr Thr Ser Tyr Thr Glu Ala Leu Val Gln Val Glu Asn Thr
465 470 475 480

Ala Ile Lys Lys Val Thr Tyr Cys Asn Ser His Ile Asn Asn Ile Lys
485 490 495

Cys Ser Gln Leu Thr Ala Asn Leu Gln Asn Gly Phe Tyr Pro Val Ala
500 505 510

Ser Ser Glu Val Gly Leu Val Asn Lys Ser Val Val Leu Leu Pro Ser
515 520 525

Phe Tyr Ser His Thr Ser Val Asn Ile Thr Ile Asp Leu Gly Met Lys
530 535 540

Arg Ser Gly Tyr Gly Gln Pro Ile Ala Ser Thr Leu Ser Asn Ile Thr
545 550 555 560

Leu Pro Met Gln Asp Asn Asn Thr Asp Val Tyr Cys Ile Arg Ser Asn
565 570 575

Gln Phe Ser Val Tyr Val His Ser Thr Cys Lys Ser Ser Leu Trp Asp
580 585 590

Asn Asn Phe Asn Gln Asp Cys Thr Asp Val Leu Tyr Ala Thr Ala Val
    595   600   605

Ile Lys Thr Gly Thr Cys Pro Phe Ser Phe Asp Lys Leu Asn Asn Tyr
    610   615   620

Leu Thr Phe Asn Lys Leu Cys Leu Ser Leu Asn Pro Thr Gly Ala Asn
625   630   635   640

Cys Lys Phe Asp Val Ala Ala Arg Thr Arg Thr Asn Glu Gln Val Val
            645   650   655

Arg Ser Leu Tyr Val Ile Tyr Glu Glu Gly Asp Asn Ile Val Gly Val
        660   665   670

Pro Ser Asp Asn Ser Gly Leu His Asp Leu Ser Val Leu His Leu Asp
        675   680   685

Ser Cys Thr Asp Tyr Asn Ile Tyr Gly Arg Thr Gly Val Gly Ile Ile
    690   695   700

Arg Gln Thr Asn Ser Thr Ile Leu Ser Gly Leu His Tyr Thr Ser Leu
705   710   715   720

Ser Gly Asp Leu Leu Gly Phe Lys Asn Val Ser Asp Gly Val Val Tyr
            725   730   735

Ser Val Thr Pro Cys Asp Val Ser Ala Gln Ala Ala Val Ile Asp Gly
            740   745   750

Ala Ile Val Gly Ala Met Thr Ser Ile Asn Ser Glu Leu Leu Gly Leu
        755   760   765

Thr His Trp Thr Thr Thr Pro Asn Phe Tyr Tyr Tyr Ser Ile Tyr Asn
    770   775   780

Thr Thr Asn Glu Arg Thr Arg Gly Thr Ala Ile Asp Ser Asn Asp Val
785   790   795   800

Asp Cys Glu Pro Ile Ile Thr Tyr Ser Asn Ile Gly Val Cys Lys Asn
            805   810   815

Gly Ala Leu Val Phe Ile Asn Val Thr His Ser Asp Gly Asp Val Gln
            820   825   830

Pro Ile Ser Thr Gly Asn Val Thr Ile Pro Thr Asn Phe Thr Ile Ser
        835   840   845

```
Val Gln Val Glu Tyr Ile Gln Val Tyr Thr Thr Pro Val Ser Ile Asp
    850                 855             860
```

```
Cys Ser Arg Tyr Val Cys Asn Gly Asn Pro Arg Cys Asn Lys Leu Leu
865             870             875                 880
```

```
Thr Gln Tyr Val Ser Ala Cys Gln Thr Ile Glu Gln Ala Leu Ala Met
            885             890             895
```

```
Ser Ala Ser Leu Glu Asn Met Glu Val Asp Ser Met Leu Phe Val Ser
            900             905             910
```

```
Glu Asn Ala Leu Lys Leu Ala Ser Val Glu Ala Phe Asn Ser Thr Glu
        915             920             925
```

```
His Leu Asp Pro Ile Tyr Lys Glu Trp Pro Asn Ile Gly Gly Ser Trp
    930             935             940
```

```
Leu Gly Gly Leu Lys Asp Ile Leu Pro Ser His Asn Ser Lys Arg Lys
945             950             955             960
```

```
Tyr Arg Ser Ala Ile Glu Asp Leu Leu Phe Asp Lys Val Val Thr Ser
            965             970             975
```

```
Gly Leu Gly Thr Val Asp Glu Asp Tyr Lys Arg Cys Thr Gly Gly Tyr
            980             985             990
```

```
Asp Ile Ala Asp Leu Val Cys Ala  Gln Tyr Tyr Asn Gly  Ile Met Val
        995             1000            1005
```

```
Leu Pro  Gly Val Ala Asn Asp  Asp Lys Met Thr Met  Tyr Thr Ala
    1010            1015            1020
```

```
Ser Leu  Ala Gly Gly Ile Ala  Leu Gly Ala Leu Gly  Gly Gly Ala
    1025            1030            1035
```

```
Val Ala  Ile Pro Phe Ala Val  Ala Val Gln Ala Arg  Leu Asn Tyr
    1040            1045            1050
```

```
Val Ala  Leu Gln Thr Asp Val  Leu Asn Lys Asn Gln  Gln Ile Leu
    1055            1060            1065
```

```
Ala Asn  Ala Phe Asn Gln Ala  Ile Gly Asn Ile Thr  Gln Ala Phe
    1070            1075            1080
```

```
Gly Lys  Val Asn Asp Ala Ile  His Gln Thr Ser Gln  Gly Leu Ala
    1085            1090            1095
```

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Thr Val  Ala Lys Ala Leu Ala  Lys Val Gln Asp Val  Val Asn Thr
    1100             1105             1110

Gln Gly  Gln Ala Leu Ser His  Leu Thr Val Gln Leu  Gln Asn Ser
    1115             1120             1125

Phe Gln  Ala Ile Ser Ser Ser  Ile Ser Asp Ile Tyr  Asn Arg Leu
    1130             1135             1140

Asp Glu  Leu Ser Ala Asp Ala  Gln Val Asp Arg Leu  Ile Thr Gly
    1145             1150             1155

Arg Leu  Thr Ala Leu Asn Ala  Phe Val Ser Gln Thr  Leu Thr Arg
    1160             1165             1170

Gln Ala  Glu Val Arg Ala Ser  Arg Gln Leu Ala Lys  Asp Lys Val
    1175             1180             1185

Asn Glu  Cys Val Arg Ser Gln  Ser Gln Arg Phe Gly  Phe Cys Gly
    1190             1195             1200

Asn Gly  Thr His Leu Phe Ser  Leu Ala Asn Ala Ala  Pro Asn Gly
    1205             1210             1215

Met Val  Phe Phe His Thr Val  Leu Leu Pro Thr Ala  Tyr Glu Thr
    1220             1225             1230

Val Thr  Ala Trp Ser Gly Ile  Cys Ala Ser Asp Gly  Asp Arg Thr
    1235             1240             1245

Phe Gly  Leu Val Val Lys Asp  Val Gln Leu Thr Leu  Phe Arg Asn
    1250             1255             1260

Leu Asp  Asp Lys Phe Tyr Leu  Thr Pro Arg Thr Met  Tyr Gln Pro
    1265             1270             1275

Arg Ala  Ala Thr Ser Ser Asp  Phe Val Gln Ile Glu  Gly Cys Asp
    1280             1285             1290

Val Leu  Phe Val Asn Ala Thr  Val Ile Asp Leu Pro  Ser Ile Ile
    1295             1300             1305

Pro Asp  Tyr Ile Asp Ile Asn  Gln Thr Val Gln Asp  Ile Leu Glu
    1310             1315             1320

Asn Tyr  Arg Pro Asn Trp Thr  Val Pro Glu Leu Thr  Ile Asp Ile
    1325             1330             1335
```

Phe Asn Ala Thr Tyr Leu Asn Leu Thr Gly Glu Ile Asp Asp Leu
    1340   1345   1350

Glu Phe Arg Ser Glu Lys Leu His Asn Thr Thr Val Glu Leu Ala
    1355   1360   1365

Ile Leu Ile Asp Asn Ile Asn Asn Thr Leu Val Asn Leu Glu Trp
    1370   1375   1380

Leu Asn Arg Ile Glu Thr Tyr Val Lys Trp Pro Trp Tyr Val Trp
    1385   1390   1395

Leu Leu Ile Gly Leu Val Val Val Phe Cys Ile Pro Leu Leu Leu
    1400   1405   1410

Phe Cys Cys Cys Ser Thr Gly Cys Cys Gly Cys Ile Gly Cys Leu
    1415   1420   1425

Gly Ser Cys Cys His Ser Ile Cys Ser Arg Arg Gln Phe Glu Asn
    1430   1435   1440

Tyr Glu Pro Ile Glu Lys Val His Val His
    1445   1450

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<211> 496
<212> DNA
<213> canine respiratory coronavirus

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aattttgggg attattatta taaggttgaa gctgatttct atttgtcagg ttgtgacgag   180

tatatcgtac cactttgtat ttttaacggc aagtttttgt cgaatacaaa gtattatgat   240

gatagtcaat attattttaa taaagacact ggtgttattt atggtttcaa ttctactgaa   300

accattaaca ctggtttttga ttttaattgt cattatttac ttttaccctc tggtaattat   360

ttagccattt caaatgagct attgttaact gttcctacga aagcaatctg tcttaataag   420

cgtaaggatt ttacgcctgt acaggttgtt gactcgcggt ggaacaatgc caggcagtct   480

gataacatga cggcgg   496

<210> 22
<211> 165
<212> PRT
<213> canine respiratory coronavirus

<400> 22

Tyr Arg Ser Leu Thr Phe Val Asn Val Pro Tyr Val Tyr Asn Gly Ser
1   5   10   15

Ala Gln Ser Thr Ala Leu Cys Lys Ser Gly Ser Leu Val Leu Asn Asn
            20   25   30

Pro Ala Tyr Ile Ala Arg Glu Ala Asn Phe Gly Asp Tyr Tyr Tyr Lys
            35   40   45

Val Glu Ala Asp Phe Tyr Leu Ser Gly Cys Asp Glu Tyr Ile Val Pro
    50   55   60

Leu Cys Ile Phe Asn Gly Lys Phe Leu Ser Asn Thr Lys Tyr Tyr Asp
65   70   75   80

Asp Ser Gln Tyr Tyr Phe Asn Lys Asp Thr Gly Val Ile Tyr Gly Phe
            85   90   95

Asn Ser Thr Glu Thr Ile Asn Thr Gly Phe Asp Phe Asn Cys His Tyr
            100   105   110

Leu Leu Leu Pro Ser Gly Asn Tyr Leu Ala Ile Ser Asn Glu Leu Leu
        115   120   125

Leu Thr Val Pro Thr Lys Ala Ile Cys Leu Asn Lys Arg Lys Asp Phe
    130   135   140

Thr Pro Val Gln Val Val Asp Ser Arg Trp Asn Asn Ala Arg Gln Ser
145   150   155   160

Asp Asn Met Thr Ala
                165

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<211> 497
<212> DNA
<213> bovine coronavirus strain LY138

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aattttgggg attattatta taaggttgaa gctgattttt atttgtcagg ttgtgacgag   180

tatatcgtac cactttgtat ttttaacggc aagtttttgt cgaatacaaa gtattatgat   240

gatagtcaat attattttaa taaagacact ggtgttattt atggtctcaa ttctactgaa   300

accattacca ctggttttga ttttaattgt cattatttag ttttaccctc tggtaattat   360

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ttagccattt caaatgagct attgttaact gttcctacga aagcaatctg tcttaataag      420

cgtaaggatt ttacgcctgt acaggttgtt gactctcggt ggaacaatgc caggcagtct      480

gataacatga cggcggt                                                     497
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<210>  24
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<213>  human coronavirus strain OC43

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aactctgggg attattatta taaggttgaa gctgatttt atttgtcagg ttgtgacgag       180

tatatcgtac cactttgtat ttttaacggc aagttttgt cgaatacaaa gtattatgat       240

gatagtcaat attattttaa taaagacact ggtgttattt atggtctcaa ttctacagaa      300

accattacca ctggttttga tcttaattgt tattatttag ttttaccctc tggtaattat      360

ttagccattt caaatgagct attgttaact gttcctacga aagcaatctg tcttaataag      420

cgtaaggatt ttacgcctgt acaggttgtt gattcgcggt ggaacaatgc caggcagtct      480

gataacatga cggcggt                                                     497
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<212>  DNA
<213>  human enteric coronavirus

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aattttgggg attattatta taaggttgaa gctgatttt atttgtcagg ttgtgacgag       180

tatatcgtac cactttgtat ttttaacggc aagttttgt cgaatacaaa gtattatgat       240

gatagtcaat attattttaa taaagacact ggtgttattt atggtctcaa ttctactgaa      300

accattacca ctggttttga ttttaattgt cattatttag ttctaccctc tggcaattat      360

ttagccattt caaatgagct attgttaact gttcctacta aagcaatctg tcttaataag      420

cgtaaggatt ttacgcctgt acaggttgtt gactcgcggt ggaacaatgc caggcagtct      480

gataacatga cggcagt                                                     497
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<210>  26
<211>  497
<212>  DNA
<213>  hemagglutinating encephalomyelitis virus

<400>  26
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gcactttgta agtctggcag tttaattctt aacaatcctg catatatagc ccgtgaggct    120

aatgtgggtg attattatta taagtctgaa gcagatttt ctctctcagg ttgtgacgag     180

tatatcgtac cactttgtat ttttaatggc aagttttgt cgaatacaaa gtattatgat     240

gatagtcaat attattttaa taaagacact ggtgttattt atggtctcaa ttctactgaa    300

accattacca ctggttttga ttttaattgt cattatttag ttctaccctc tggtaattat    360

ctagccattt caaatgagct attgttaact gttcctacta aagcaatctg tcttaataag    420

cgtaaggttt ttacgcctgt acaggttgtt gattcgcggt ggaacaatgc caggcaatct    480

gataacatga cggcagt                                                   497
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<210>   27
<211>   165
<212>   PRT
<213>   bovine coronavirus strain LY138

<400>   27

Tyr Arg Ser Leu Thr Phe Val Asn Val Pro Tyr Val Tyr Asn Gly Ser
1               5                   10                  15


Ala Gln Ser Thr Ala Leu Cys Lys Ser Gly Ser Leu Val Leu Asn Asn
            20                  25                  30


Pro Ala Tyr Ile Ala Arg Glu Ala Asn Phe Gly Asp Tyr Tyr Tyr Lys
            35                  40                  45


Val Glu Ala Asp Phe Tyr Leu Ser Gly Cys Asp Glu Tyr Ile Val Pro
    50                  55                  60


Leu Cys Ile Phe Asn Gly Lys Phe Leu Ser Asn Thr Lys Tyr Tyr Asp
65                  70                  75                  80


Asp Ser Gln Tyr Tyr Phe Asn Lys Asp Thr Gly Val Ile Tyr Gly Leu
                85                  90                  95


Asn Ser Thr Glu Thr Ile Thr Thr Gly Phe Asp Phe Asn Cys His Tyr
                100                 105                 110


Leu Val Leu Pro Ser Gly Asn Tyr Leu Ala Ile Ser Asn Glu Leu Leu
            115                 120                 125


Leu Thr Val Pro Thr Lys Ala Ile Cys Leu Asn Lys Arg Lys Asp Phe
            130                 135                 140


Thr Pro Val Gln Val Val Asp Ser Arg Trp Asn Asn Ala Arg Gln Ser
145                 150                 155                 160
```

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Asp Asn Met Thr Ala
                165

<210>   28
<211>   165
<212>   PRT
<213>   human coronavirus strain OC43

<400>   28

Tyr Arg Ser Leu Thr Phe Val Asn Val Pro Tyr Val Tyr Asn Gly Ser
1   5   10   15

Ala Gln Ser Thr Ala Leu Cys Lys Ser Gly Ser Leu Val Leu Asn Asn
          20   25   30

Pro Ala Tyr Ile Ala Pro Gln Ala Asn Ser Gly Asp Tyr Tyr Tyr Lys
         35   40   45

Val Glu Ala Asp Phe Tyr Leu Ser Gly Cys Asp Glu Tyr Ile Val Pro
     50   55   60

Leu Cys Ile Phe Asn Gly Lys Phe Leu Ser Asn Thr Lys Tyr Tyr Asp
65   70   75   80

Asp Ser Gln Tyr Tyr Phe Asn Lys Asp Thr Gly Val Ile Tyr Gly Leu
          85   90   95

Asn Ser Thr Glu Thr Ile Thr Thr Gly Phe Asp Leu Asn Cys Tyr Tyr
          100   105   110

Leu Val Leu Pro Ser Gly Asn Tyr Leu Ala Ile Ser Asn Glu Leu Leu
          115   120   125

Leu Thr Val Pro Thr Lys Ala Ile Cys Leu Asn Lys Arg Lys Asp Phe
          130   135   140

Thr Pro Val Gln Val Val Asp Ser Arg Trp Asn Asn Ala Arg Gln Ser
145   150   155   160

Asp Asn Met Thr Ala
                165

<210>   29
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<212>   PRT
<213>   human enteric coronavirus

<400>   29

Tyr Arg Ser Leu Thr Phe Val Asn Val Pro Tyr Val Tyr Asn Gly Ser

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Ala Gln Ser Thr Ala Leu Cys Lys Ser Gly Ser Leu Val Leu Asn Asn
            20                  25                  30


Pro Ala Tyr Ile Ala Arg Glu Ala Asn Phe Gly Asp Tyr Tyr Tyr Lys
            35                  40                  45


Val Glu Ala Asp Phe Tyr Leu Ser Gly Cys Asp Glu Tyr Ile Val Pro
    50                  55                  60


Leu Cys Ile Phe Asn Gly Lys Phe Leu Ser Asn Thr Lys Tyr Tyr Asp
65                  70                  75                  80


Asp Ser Gln Tyr Tyr Phe Asn Lys Asp Thr Gly Val Ile Tyr Gly Leu
                85                  90                  95


Asn Ser Thr Glu Thr Ile Thr Thr Gly Phe Asp Phe Asn Cys His Tyr
            100                 105                 110


Leu Val Leu Pro Ser Gly Asn Tyr Leu Ala Ile Ser Asn Glu Leu Leu
            115                 120                 125


Leu Thr Val Pro Thr Lys Ala Ile Cys Leu Asn Lys Arg Lys Asp Phe
    130                 135                 140


Thr Pro Val Gln Val Val Asp Ser Arg Trp Asn Asn Ala Arg Gln Ser
145                 150                 155                 160


Asp Asn Met Thr Ala
                165


<210>   30
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<212>   PRT
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Tyr Arg Ser Leu Thr Leu Val Asn Val Pro Tyr Val Tyr Asn Gly Ser
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Ala Gln Pro Thr Ala Leu Cys Lys Ser Gly Ser Leu Ile Leu Asn Asn
            20                  25                  30


Pro Ala Tyr Ile Ala Arg Glu Ala Asn Val Gly Asp Tyr Tyr Tyr Lys
            35                  40                  45


Ser Glu Ala Asp Phe Ser Leu Ser Gly Cys Asp Glu Tyr Ile Val Pro
    50                  55                  60
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Leu Cys Ile Phe Asn Gly Lys Phe Leu Ser Asn Thr Lys Tyr Tyr Asp
65              70              75              80


Asp Ser Gln Tyr Tyr Phe Asn Lys Asp Thr Gly Val Ile Tyr Gly Leu
            85              90              95


Asn Ser Thr Glu Thr Ile Thr Thr Gly Phe Asp Phe Asn Cys His Tyr
            100             105             110


Leu Val Leu Pro Ser Gly Asn Tyr Leu Ala Ile Ser Asn Glu Leu Leu
        115             120             125


Leu Thr Val Pro Thr Lys Ala Ile Cys Leu Asn Lys Arg Lys Val Phe
    130             135             140


Thr Pro Val Gln Val Val Asp Ser Arg Trp Asn Asn Ala Arg Gln Ser
145             150             155             160


Asp Asn Met Thr Ala
                165
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<223>  Consensus oligonucleotide primer for coronavirus polymerase gene

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<220>
<223>  Consensus oligonucleotide primer for coronavirus polymerase gene

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<210>  33
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<220>
<223>  Consensus oligonucleotide probe for coronavirus polymerase gene

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<213>   bovine coronavirus strain LY138

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<210>   36
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<210>   39
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<210>  44
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<213>  bovine coronavirus strain LY138

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<210>  47
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<400>  47
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<220>
<223>   Oligonucleotide primer for cloning canine respiartory coronavirus
         Spike gene

<400>   50
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         Spike gene

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<213>   Unknown

<220>
<223>   Presumed T cell epitope

<400>   52

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